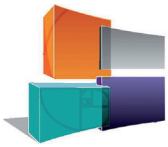
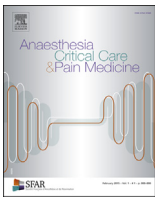
Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Anaesth Crit Care Pain Med 39 (2020) 579–580



SFAR
Société Française d'Anesthésie et de Réanimation



Letter to the Editor

Outcome of non-invasive ventilation in COVID-19 critically ill patients: A Retrospective observational Study

Dear Editor,

Despite the existing evidence of superiority of invasive over non-invasive mechanical ventilation in patients with moderate-to-severe ARDS, there is a marked variability in using non-invasive mechanical ventilation (NIV) in these patients. The use of NIV in patients with non-COVID ARDS ranged from 18% to 42% in USA Hospitals [1]. The difference in practice is not clearly understood; however, it might be related to the centre's preference and the absence of clear triggering cut-off point for initiating invasive ventilatory support.

In patients with COVID-19, the variability in the choice between invasive mechanical ventilation (IMV) and NIV may be even magnified because this choice is impacted by frequent lack of resources. Early reports suggested that NIV is not preferred in these patients for the fear of increased risk of aerosolisation. However, this belief is changing towards a more conservative use of IMV whenever possible due to claimed high mortality rate [2]. There is still no clear evidence for the outcomes of the use of NIV in these patients. In this study, we present our experience with the use of NIV in patients with COVID-19 who were admitted to the intensive care unit (ICU) with ARDS.

The study included all patients with laboratory-confirmed COVID-19 who were admitted to ICU at Cairo University Hospital during the period from May 14, 2020 until July 1, 2020. The study was approved by the institutional research ethics board (N-76-2020). Demographic data, oxygenation indices and radiologic results were obtained during ICU admission and patients' follow up. Upon admission to the ICU, all patients were initially treated with facemask oxygen. The oxygen flow was adjusted to keep an oxygen saturation (SpO2) of 92-96%. If the respiratory rate did not fall below 30/min and/or the SpO2 did not reach the target, NIV was initiated. Worsening of dyspnea, worsening/or lack of improvement in hypoxemia (defined as SpO2 $<$ 90%), persistence of respiratory rate $>$ 35 breaths/min, appearance of respiratory acidosis (defined as pH $<$ 7.3 and arterial carbon dioxide tension $>$ 50 mmHg), circulatory shock (defined as use of vasopressor to maintain mean arterial pressure above 65 mmHg), or altered sensorium as the features of NIV failure. A patient who developed any feature of NIV failure was qualified for IMV. All patients had a computed tomography (CT) scan upon ICU admission, and the CT images were scored by an experienced radiologist who was blinded to the clinical data. The primary outcome was the success of NIV, defined as the number of patients in whom endotracheal intubation was avoided. Patients were divided into oxygen therapy group, NIV group and IMV group. The three groups were compared according to demographic data, baseline investigations, CT score, and final outcomes.

Fifty-five critically ill patients with confirmed COVID-19 infection were included in the study. Among them, 39 patients (71%) required ventilatory support, 30 (77%) with successful NIV and 9 (23%) requiring IMV. Patient characteristics at admission were similar between patients of oxygen therapy, NIV and IMV groups, respectively (table). The PaO2/FiO2 did not differ between the three groups; however, the median SpO2 measured at the room air was lower in the NIV and IMV groups relative to the oxygen therapy group (Table 1). In the NIV group, the median (inter-quartile range (IQR)) time for duration of NIV was 2 (2-5) days, while in the IMV group, the median time to intubation was 2 (IQ) days. Four patients failed NIV within the first 48 hours because of refractory hypoxemia, while 5 patients failed NIV after 48 hours. The causes of delayed failure were sepsis and hypotension. During the study period, 10/55 patients died (18%); 7/9 in the IMV group (78%) and 3/30 patients in the NIV group (10%) respectively, P = 0.001. The median (IQR) CT score at ICU admission in the oxygen therapy group was significantly lower than both in the NIV and IMV groups: 10 (7-12), 16 (13-19) and 15 (11-20) respectively, $P <$ 0.0001. However, the CT score did not differ significantly between the latter two groups.

The main finding of the present study was that the use of NIV is feasible with a high success rate and helped in avoiding IMV in 77% of patients with severe COVID-19 disease. Since the first publication from Wuhan, several studies have published their experience in management of COVID-19 patients. Recent report showed that the use of NIV ranged from 0% to 11% [3]. In the present study, NIV was required in 39/55 (71%) patients and was successful in 30 patients (77%).

The successful use of NIV in our cohort cannot be merely explained by less severity of the disease. In general, there is no specific definition for COVID-19 ARDS to categorise the severity of the disease. Recent report mentioned that IMV was used in 88% of patients when patients' PaO2 /FiO2 ratio was ranged from 182 (IQR 135–245) [4]. Compared to the aforementioned value, PaO2/FiO2 of our patients in NIV group [170(112-224)] was lower; however, this was not associated with high NIV failure rate. CT score is an emerging tool to identify the disease severity in SARS CoV-2. A recent study found that admission median CT score $\geq$ 13 was found to be an independent predictor for mechanical ventilation and/or death [5]. In our study, a higher median CT score (20 (IQR?)) was not associated with either higher NIV failure rate or mortality.

In the present study, the overall mortality reaches 18% with high mortality rate in patients requiring IMV (75%). Recently, Hua et al. reported that the mortality in patients who required IMV was 90%, which was double the mortality found in patients managed with NIV [2].

In conclusion, use of NIV with a predefined algorithm in subjects with moderate-to-severe COVID-19 ARDS was successful in 77% of the subjects. We support the mounting method towards avoidance of IMV whenever possible in these patients.

https://doi.org/10.1016/j.accpm.2020.07.012

Table 1
Patients characteristics, respiratory status, ICU stay, and hospital mortality. Data are presented as mean (sd), median (IQR) or number (%).

Characteristics	All Patients (N = 55)	Oxygen therapy group (N = 16)	NIV group (N = 30)	Invasive ventilation group (N = 9)	*P* value
Sex (Male (%))	36 (65%)	13 (81%)	15 (50%)	8 (89%)	0.03
Age (years)	59 (14)	51 (9)[b]	59 (14)	65 (14)	0.027
Weight (kg)	96 (20)	103 (22)	94 (18)	94.8 (23)	0.7
APACHE II	10 (4.4)	8 (4)	10 (4)	11 (5.5)	0.2
Co-existing disorder					
Chronic cardiac disease (%)	9 (16%)	2(12%)	4 (13%)	3 (33%)	0.3
Chronic pulmonary disease (%)	3 (5%)	0	1 (3%)	2 (22%)	0.048
Chronic diabetes	28 (51%)	8 (50%)	13 (43%)	7 (77%)	0.2
Chronic (%) hypertension (%)	31 (56%)	10 (62%)	16 (53%)	5 (55%)	0.8
Smoking (%)	9 (16%)	3 (18%)	1 (3%)	5 (55%)[a]	0.001
Obesity (%)	15 (27%)	4 (25%)	8 (26%)	3 (33%)	0.89
Respiratory status					
Admitted PaO2/FiO2	190 (123-247)	250 (180-298)	170 (112-224)	175 (118-205)	0.07
Admitted SPO2 on room air (%)	79% (70%-87%)	89(85-90)[a]	77(69-84)	70(60-78)	< 0.0001
CT score (0-25)		10 (7-12)[a]	16 (13-20)	15 (12-20)	< 0.0001
ICU stay (days)	5 (3-7)	3 (2-3)[a]	7 (4-8)	7 (3-18)	< 0.0001
Hospital mortality (%)	10 (18.2%)	0	3 (10%)	7 (77%)[a]	< 0.0001

[a] Significant relative to other two groups. $P < 0.05$.
[b] Significant relative to invasive mechanical ventilation group. $P < 0.05$.

Funding

This work was funded by Cairo University.

Declarations of interest

None.

References

[1] Mehta A, Douglas I, Walkey A. Evidence-based Utilization of Noninvasive Ventilation and Patient Outcomes. Ann Am Thorac Soc 2017;14:1667–73. http://dx.doi.org/10.1513/AnnalsATS.201703-208OC.
[2] Hua J, Qian C, Luo Z, Li Q, Wang F. Invasive mechanical ventilation in COVID-19 patient management : the experience with 469 patients in Wuhan. Crit Care 2020;24:348. http://dx.doi.org/10.1186/s13054-020-03044-9.
[3] Wunsch H. Mechanical ventilation in COVID-19: Interpreting the current Epidemiology. Am J Respir Crit Care Med 2020;202:1–4. http://dx.doi.org/10.1164/rccm.202004-1385ED.
[4] Ziehr DR, Alladina J, Petri CR, Maley JH, Moskowitz A, Medoff BD, et al. Respiratory Pathophysiology of Mechanically Ventilated Patients with COVID-19: A Cohort Study. Am J Respir Crit Care Med 2020;201(12):1560–4. http://dx.doi.org/10.1164/rccm.202004-1163LE.
[5] Mahdjoub E, Mohammad W, Lefevre T, Debray MP, Khalil A. Admission chest CT score predicts 5-day outcome in patients with COVID-19. Intensive Care Med 2020. http://dx.doi.org/10.1007/s00134-020-06118-y. ahead of print.

Ahmed Mukhtar[a,*], Ahmed Lotfy[a], Ahmed Hasanin[a], Islam El-Hefnawy[b], Akram El Adawy[a]
[a]*Anaesthesia Department, Cairo University, Cairo, Egypt*
[b]*Radiology Department Cairo University, Cairo, Egypt*

[*]Corresponding author at: Anaesthesia and Critical Care, Cairo University Hospital, Cairo, Egypt
E-mail address: Ahmed.Mukhtar@kasralainy.edu.eg (A. Mukhtar).

Available online 28 July 2020